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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/823,773
Filing Date: April 14, 2004
Appellant(s): HAMADA ET AL.

Paul D. Strain
FOLEY & LARDNER LLP
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 5/16/07 appealing from the Office action mailed 8/16/06.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings, which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final to the claims has been filed. However, on September 6, 2006, Applicants submitted a replacement-drawing sheet in response to a Notice of Non-Compliant Amendment dated August 11, 2006. Contrary to applicant's statement, the USPTO has acknowledged receipt of the replacement drawing on a miscellaneous communication mailed 09/28/06.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. The changes are as follows:

(1) Only pending claim 1 is rejected under 35 U.S.C. §103(a) over Dam et al (US 6,715,693). Claims 2-7 are rejected under 35 U.S.C. §103(a) over Dam et al. (US 6,715,693) in view of Haji et al. (6,514,298). The indication on the Final Office Action

that claims 1-7 are rejected under 35 U.S.C. §103(a) over Dam et al (US 6,715,693), instead of only claim 1, is a typographical error. It is, however, clear from the body of the rejections that claim 1 is rejected over Dam et al and claims 2-7 are rejected over Dam et al. in view of Haji et al

(2) Similarly, Only pending claim 1 is rejected under 35 U.S.C. §103(a) over Coffinberry (US 6,156,439), and claims 2-7 are rejected under 35 U.S.C. §103(a) over Coffinberry (US 6,156,439) in view of Haji et al. (6,514,298). The indication on the Final Office Action that claims 1-7, instead of only claim 1, is also an unintended typographical error. However, it is also clear from the body of the rejections that claim 1 is rejected over Coffinberry and claims 2-7 are rejected over Coffinberry in view of Haji et al.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,715,693	Dam et al.	04-2004
6.514,298	Haji et al.	02-2003
6,156,439	Coffinberry	12-2000

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claim 1 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Dam et al (6,715,693).

Dam et al (Dam '693) disclose a fuel injection valve (14) comprising: a needle valve (86) including a base material (95); an opposite member (nozzle, not numbered, see figure 1) including a base material (of the nozzle) whose sliding section is in slidable contact with a sliding section of the base material of the needle valve (86) in presence of fuel (between the needle and the nozzle) for an automotive vehicle; and a hard carbon (metal carbon) thin film (96) coated on at least one of the sliding sections of the base materials of the needle valve (86) and the opposite member (nozzle), the hard carbon thin film having a surface hardness ranging from 1500 to 4500 kg/mm^2 in Knoop hardness (hardness of greater than 1000 kg/mm^2, see col. 6 and ll. 9), a film thickness ranging from 0.3 to 2.0 μm (thickness desirably no greater than about 2.0 microns, and preferably between 0.5 and 1.7 microns, see col. 5 and ll. 11-16).

Dam '693 does not disclose a formula for roughness (Ry) that specifies the range of desirable roughness values. However, the range of permissible values for each

independent variable (Hk, h) on the right side of the formula is disclosed (that is a surface hardness greater than 1000 kg/mm^2 and film thickness of less than or equal to 2.0 μm).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to operate the thin coated fuel injector of Dam et al with a surface roughness value below the maximum value of roughness specified by the formula (Ry< 1.21 μm), since Dam et al. suggest the desirability of a smooth contact surface between the exterior surface of the fuel injection needle and the cooperating interior surface of the injector body or guide surface (col. 2, ll. 1-10). The motivation to do so would have been to inject the correct amount of fuel injection into the system, see col. 2 and ll. 5-6.

3. Claims 2-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dam et al (6,715,693) in view of Haji et al (6,514,298).

Dam '693 discloses all the limitations as applied to claim 1 above except for ester or amine-based additives.

Haji '298 discloses ester-based additive (col. 21 and ll. 66-67; col. 22 and ll. 6; col. 1 and l. 33) selected at least from one of the groups.

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to add additives to the fuel. The motivation to do so would have been to provide additives with superior detergent effect for conventional gasoline and excellent detergency of injection nozzles of a diesel engine, see abstract of Haji et al.

Regarding claim 3, Haji et al. discloses at least corrosion or oxidation inhibitor, col. 16 and l. 2.

Regarding claims 4-6, it is well know in the art that hard carbon has microcrystal structure and is composed of carbon and hydrogen (for instance, see abstract of 5,008, 732 to Kondo et al. as extrinsic evidence)

Regarding claim 7, Dam et al. disclose the range of values for the independent variables in the equation or inequality and consequently the dependent values that are determined by the disclosed values for the independent variable of hardness and thickness.

Claim Rejections - 35 USC § 103

4. Claims 1 are rejected under 35 U.S.C. 103(a) as being unpatentable over Coffinberry (6,156,439).

Coffinberry discloses a fuel injection valve (col. 4 and ll. 64-65) comprising: a needle valve including a base material (12); an opposite member including a base material (14) whose sliding section is in slidable contact with a sliding section of the base material of the needle valve in presence of fuel for an automotive vehicle; and a hard carbon (col. 7 and l. 3) thin film coated on at least one of the sliding sections of the base materials of the needle valve and the opposite member, the hard carbon thin film having an optimal surface hardness (col. 7 and l. 16) , a film thickness ranging from 0.3 to 2.0 μm (thickness of at least 0.5 micrometers, col. 6 and 51) and surface roughness below 4 microns (col. 3 and ll. 31-33).

Coffinberry does not specify the value of surface hardness, however teaches that the surface has an optimal surface roughness (col. 7 and l. 16).

It would have been obvious to one of ordinary skill in the art at the time of the invention to recognize an optimum range for the surface hardness as suggested by Coffinberry, since it has been held that discovering the optimum range involves only routine skill in the art, in re Aller, 105 USPQ 233. The motivation to do so would have been to optimize surface roughness.

5. Claims 2-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Coffinberry (6,156,439) in view of Haji et al (6,514,298).

Coffinberry discloses all the limitations as applied to claim 1 above except for ester- or amine-based additives.

Haji '298 discloses ester-, or amine-based additives (col. 21 and ll. 66-67; col. 22 and ll. 6; col. 1 and l. 33) selected at least from one of the groups.

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to add additives to the fuel. The motivation to do so would have been to provide detergent effect to conventional gasoline and detergency of fuel injection nozzles of a diesel engine, see abstract of Haji et al.

Regarding claim 3, Haji et al. discloses at least corrosion or oxidation inhibitor, col. 16 and l. 2.

Regarding claim 4, it is well know in the art that hard carbon is composed of carbon and hydrogen (for instance, see abstract of 5,008, 732 to Kondo et al. as extrinsic evidence)

Regarding claims 5 and 6, Coffinberry teaches the layer 16 containing carbon is "diamond-like", col. 7 and ll. 1-3.

Regarding claim 7, Coffinberry teaches that the surface roughness to be no more than 4 micrometers, col. 3 and ll. 31-33

(10) Response to Argument

(1) In the arguments received 5/16/07, the appellants contend that a prima facie case of obviousness has not been made based on US Patent 6,715,693 to Dam et al. (herein after Dam) alone or Dam et al. (6,715,693) in view of Haji et al. (6,514,298).

(a) Rejection of claim 1 under 35 U.S.C. 103(a) as being unpatentable over Dam et al (6,715,693).

(i) Appellants argued that the formula "(A)" defines a relationship between 3 variables (Ry, Hk, and h) and that the surface roughness (Ry) is not an "automatic" result of a surface having surface hardness (Hk) and thickness (h) within the presently claimed range as suggested by the USPTO. In addition, applicants argued that this conclusion is based on an incorrect presumption that the presently claimed formula is a mathematical equation. They argued that the value of Ry is not automatically generated because the formula is an inequality rather than an equation.

Dam discloses hardness values "greater than 1000 kg/mm^2" (see col. 6 and ll. 9) and film thickness values no greater than about 2.0 microns, and preferably between 0.5 and 1.7 microns (see col. 5 and ll. 11-16). The claimed values for hardness (Hk) is in the range of 1500 to 4500 kg/mm^2, and the claimed values for film thickness (h) is in the range of 0.3 to 0.20 microns. In addition Dam suggests the desirability of a smooth contact surface between the exterior surface of the fuel injection needle and the cooperating interior surface of the injector body or guide surface (col. 2, ll. 1-10) because such a surface enables the fuel injector to inject the correct amount of fuel into the system, see col. 2 and ll. 5-6.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to operate the fuel injector disclosed by Dam et al with a desired surface roughness value below the maximum value of roughness specified by the formula (Ry< 1.21 μm) as suggested by Dam (col. 2, ll. 1-10). The motivation to do so would have been to inject the correct amount of fuel injection into the system, see col. 2 and ll. 5-6.

With regard to applicant's argument that the equation is inequality rather than equation, it is useful to note that both equations and inequalities follow the same principles of addition and multiplication. The only difference is when multiplying both sides with negative number. The claimed inequality excludes multiplying with negative number, because the claimed range of values of Hk and h are positive.

(ii) Rejection of claim 2-7 under 35 U.S.C. 103(a) as being unpatentable over Dam et al (6,715,693) in view of Haji et al. (6,514,298).

Applicants argued that Dam and Haji, whether taken individually or in combination, fail to teach or suggest "a surface roughness (Ry) (pm) which satisfies a relationship represented by the following formula (A): Ry (0.75 - Hk/8000) x h + 0.0875

In response, Dam discloses all the limitations as applied to claim 1 above except for ester-based and amine-based additives to inhibit oxidation. Haji discloses fuel additives to be used with fuel injection nozzles of diesel engines (abstract) that include ester-based (col. 21 and ll. 66-67), and amine-based additives to inhibit oxidation (col. 16 and ll. 1-2). The motivation to do so would have been to provide additives with superior detergent effect for conventional gasoline and excellent detergency of injection nozzles of a diesel engine, see abstract of Haji et al.

(iii) Rejection of claim 1 under 35 U.S.C. 103(a) as being unpatentable over Coffinberry (6,156,439)

(a) Appellants argued that Coffinberry fails to teach or suggest a "hard carbon thin film having a surface hardness ranging from 1500 to 4500 Kg/mm^2 in Knoop hardness" as recited in claim 1.

In response, Coffinberry discloses the range of values for two of the variables-film thickness as being below 2.0 μm and surface roughness as being below 4.0 μm- as claimed and teaches that the surface layer has a conventional, optimal, hardness and low friction (col. 7 and ll. 12-18) as disclosed in three other patents from the prior art

(hardness of more than 200 kg/mm^2) and incorporated by reference (col. 7 and ll. 12-18). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the surface hardness to a value that falls within the range of values predicted by the formula, since it has been held that discovering the optimum range involves only routine skill in the art, in re Aller, 105 USPQ 233. The motivation to do so would have been to optimize surface roughness.

(b) Appellants argued that Coffinberry fails to disclose "hard carbon thin film coating on at least one of the sliding sections".

In response, Coffinberry teaches that a particular suitable coating 14 includes carbon in a diamond-like state. It is believed that a coating with such properties is a hard carbon. It is also noted that appellants' claims 5 and 6 requires a hard carbon thin film that is a diamond-like carbon thin film. Appellants' description of a hard carbon thin film is consistent with Coffinberry's description of a coating including carbon in a diamond-like state.

(iv) Rejection of claims 2-7 under 35 U.S.C. 103(a) as being unpatentable over Coffinberry (6,156,439) in view of Haji et al. (6,514,298).

(a) Applicants argued that Coffinberry and Haji, whether taken individually or in combination, fail to teach or suggest "hard carbon thin film having a surface hardness (Hk) ranging from 1500 to 4500 kg/mm2 in Knoop hardness" as recited in claim 1.

(a) In response, Coffinberry discloses all the limitations as applied to claim 1 above, except for ester-based and amine-based additives to inhibit oxidation. Haji '298 discloses fuel additives to be used with fuel injection nozzles of diesel engines (abstract) that include ester-based (col. 21 and ll. 66-67), and amine-based additives to inhibit oxidation (col. 16 and ll. 1-2). The motivation to do so would have been to provide additives with superior detergent effect for conventional gasoline and excellent detergency of injection nozzles of a diesel engine, see abstract of Haji et al

(b) Appellants argued that Coffinberry fails to disclose "hard carbon thin film coating on at least one of the sliding sections".

In response Coffinberry teaches that a particular suitable coating 14 includes carbon in a diamond-like state. It is believed that a coating with such properties is a hard carbon. It is also noted that appellants' claims 5 and 6 requires a hard carbon thin film that is a diamond-like carbon thin film. Appellants' description of a hard carbon thin film is consistent with Coffinberry's description of a coating including carbon in a diamond-like state.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Mahmoud Gimie, Primary Examiner

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